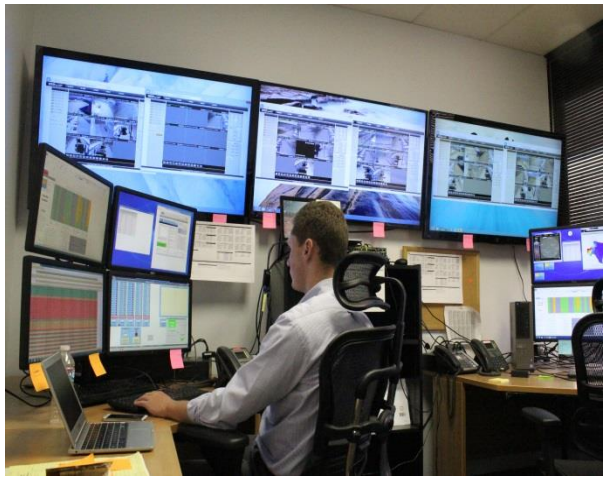
ENCHANTED ROCK
TECHNOLOGY. ENERGY.



NEW SOLUTIONS FOR ELECTRICAL RESILIENCY

TEXAS ENERGY SUMMIT

SEPTEMBER 26, 2018

ALLAN SCHURR, CHIEF COMMERCIAL OFFICER

Enchanted Rock Background

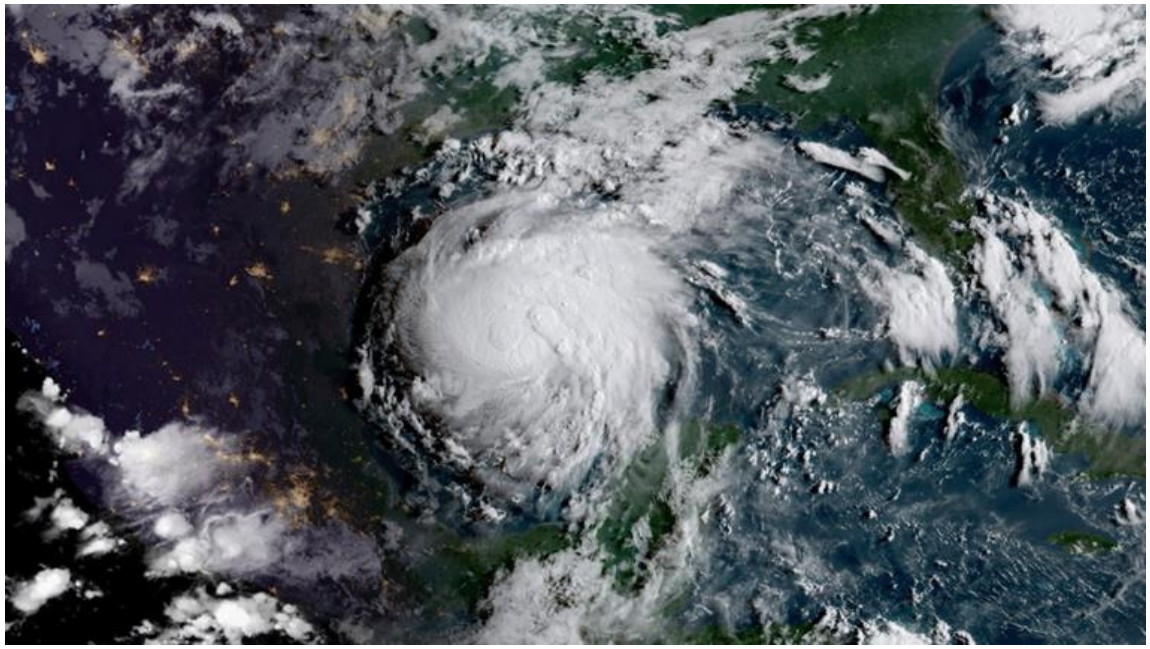
- Enchanted Rock designs, finances, builds and operates ultra-clean resiliency microgrids to provide electrical reliability as a service to large commercial, industrial, and institutional enterprises
- Market leadership since 2009 in resiliency-as-a-service
  - SCALE: 337 MW of distributed generation with another 47 MW under construction
  - EXPERIENCE: Largest dispatchable distributed generation fleet in Texas

Presentation Summary

- Need for electrical resiliency
- Resiliency-as-a-service
- HEB Case Study
- Midstream Processing Facility Case Study
- Challenges for Resiliency Microgrids

Increasing Vulnerability of the Grid

- **Electric distribution** is the weak point of the electric delivery system
  - "…the threat lies mostly with the transmission and distribution systems, where virtually all significant disruptions occur." – Commissioner Glick, FERC
- Vulnerable to weather, construction, traffic, wildlife, equipment failure
- Increasing occurrence of severe weather events



Growing risks to electricity infrastructure

Natural Hazards	Direct Physical Threats	Other Threats Hazards, and Vulnerability
Ice, snow and extreme cold weather	Physical attacks	Geomagnetic and electromagnetic pulses
Thunderstorms, tornados and hurricane-force winds	Cyber attacks	Aging infrastructure
Storm surge, flooding and increased precipitation		Capacity Constraints
Increasing temperature and extreme hot weather		Workforce turnover and loss of institutional knowledge
Earthquakes		Human Error
Wildfires		Dependencies and supply chain interruptions

Adapted from Argonne National Laboratory, 2016

Economic Implications for Customers

Loss of product or operations

Consumer inconvenience

Regulatory non-compliance and penalties

Product quality degredation

Consumer defection

Data loss

Decreased sales

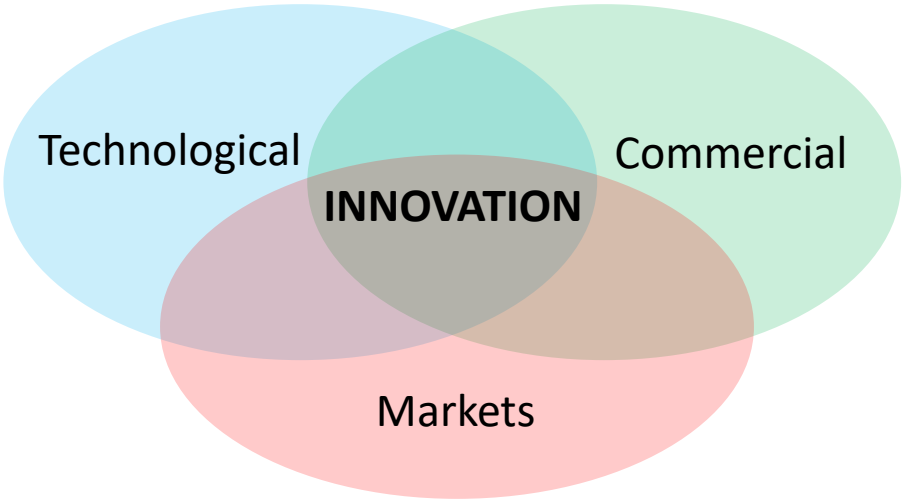
Health and safety risk

RESILIENCY-AS-A-SERVICE

Enchanted Rock's Edge

Transforming the interaction between technology and energy markets

- **Technological**
  - Quick response
  - Ultra-quiet
  - Natural Gas microgrid
    - Emissions & footprint



- **Financing/Energy Markets**
  - Investors take the vast majority of the capital risk and are repaid through electricity market revenues
- **Commercial**
  - Customer: Resiliency-as-a-service contract reduces total cost of ownership by 50-90%

Business Model: Maximize grid value to dramatically reduce cost to the customer and increase reliability.

- Run often, run loaded

Aggregated Microgrids - Grid Support

- When customers aren't using backup power, ERock aggregates the microgrids and sells back to the grid to earn revenue

- Enables rapid integration of renewables by supplying quick response capacity to the grid to help manage negative net load curves and low grid inertia

Shift from Diesel to Natural Gas

Natural Gas is More Resilient

- A resiliency microgrid has to have an **infinite** fuel source behind it, otherwise it's not resilient
  - Natural gas is delivered through incredibly robust underground infrastructure that remains unaffected by severe weather
  - Diesel systems require fuel delivery that is not always possible during natural disasters

Shift from Diesel to Natural Gas

Natural Gas Has Lower Impact

- All NG Emissions less than Diesel Emissions
- NG generators have an emission rate of:
  - less than 1% of a standard Tier 2 diesel generator
  - less than 4% of a standard Tier 4 diesel generator
- Sound
  - Compression ratio of NG generator < 50% of diesel
  - Much easier to reach sound levels while maintaining a small enclosure

2018 TCEQ Texas Environmental Excellence Award

- ERock was the recipient of the 2018 Texas Environmental Excellence Award for the Technical/Technology category

- At ERock, we are committed to serving our customers as well as our community, which is why we make carbon footprint reduction a top priority

- https://www.tceq.texas.gov/p2/events/teea/winners/teea-winners-2018/teea-winners-2018

HEB CASE STUDY

HEB Case Study

- Hurricane Ike → trailer-mounted diesel gens worked well but highlighted vulnerability of diesel supply chain after severe weather events
- Memorial Day Flood 2015 and Tax Day Flood 2016 – permanently installed backup generator ideal
- Cost of business interruption
- HEB did not want diesel
- HEB wanted onsite generation, couldn't afford cost of NG @ $1MM/MW

- ERock proposes On Demand Electric Reliability → **maximize grid revenues to minimize the price the customer has to pay**
- HEB decides to move forward with ERock given compelling value proposition, >100MW under contract

Utility Outages May 1st – September 18th

- Since May 1st, Enchanted Rock has covered:
  - **119 outages** over 15 minutes for a total of **131 hours**
  - **10 outages** over 4 hours for a total of **61 hours**

HEB San Felipe Outage – No Weather Event

- February 9th, 2018: Loss of grid power that lasted for over 7.5 hours
  - HEB stayed open for the entire event because of their microgrids
- Resiliency microgrids:
  - Allowed HEB San Felipe to stay in business
  - Prevented the store from losing revenue and refrigerated inventory

Severe Weather Event

- 18 HEB and 3 Buc-ee's stores were able to remain open and serve their community during Hurricane Harvey because they had resiliency microgrids
  - These microgrids powered 21 sites for over 105 hours

- Allowed Buc-ee's and HEB to provide a critical service to the community – both served as a headquarters for the National Guard

MIDSTREAM PROCESSING FACILITY CASE STUDY

Midstream Processing Facility Case Study

Problem:

- Customer experiences frequent power quality issues and deviations from nominal voltage and frequency
  - Not always loss of power, but plant shut down and equipment damage occurs
    - Once shut down, plant takes a day and a half to restart
- Customer also experiences long term power outages
- Permian basin location experiencing rapid load growth that leads to persistent power availability and power quality issues

Solution:

- Natural gas generators + ride through line interactive UPS
- Solves short term power quality issues and long term power availability issues


ENCHANTED ROCK
TECHNOLOGY. ENERGY.
ENCHANTED ROCK
TECHNOLOGY. ENERGY.

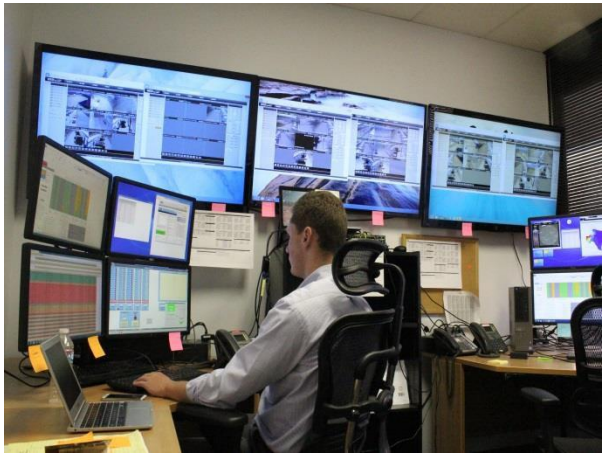
Overcoming Challenges for Resiliency Microgrids

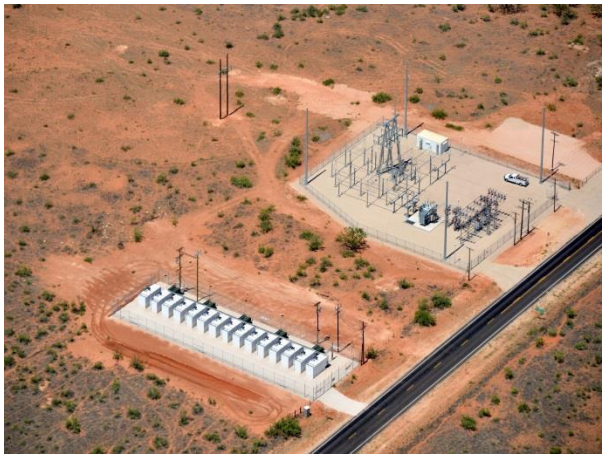
CHALLENGES		ENCHANTED ROCK SOLUTION
□ Requires large upfront capital	→	□ "As a Service" model reduces upfront cost, ERock wears all market risk
□ Uses emerging or unproven technology	→	□ Gen-set modular based on 16 million hour engine, off the shelf components
□ On-site fuel storage permitting and supply chain	→	□ Natgas is the most reliable energy network, no refueling necessary
□ Not enough space at my location	→	□ Unique design has high power density form factor


ENCHANTED ROCK


RELLIS
THE TEXAS A&M UNIVERSITY SYSTEM
ENCHANTED ROCK
TECHNOLOGY. ENERGY.


H-E-B
ENCHANTED ROCK
TECHNOLOGY. ENERGY.





Thank You

aschurr@EROCKHOLD.com